US009537294B2

(12) **United States Patent**
Kato et al.

(10) **Patent No.: US 9,537,294 B2**
(45) **Date of Patent: Jan. 3, 2017**

(54) **INTEGRATED SHIELDING PROTECTOR AND WIRE HARNESS**

(75) Inventors: **Takashi Kato**, Makinohara (JP); **Tatsuya Oga**, Kosai (JP)

(73) Assignee: **YAZAKI CORPORATION**, Tokyo (JP)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 428 days.

(21) Appl. No.: **13/805,125**

(22) PCT Filed: **Jun. 15, 2011**

(86) PCT No.: **PCT/JP2011/063710**
§ 371 (c)(1),
(2), (4) Date: **Dec. 18, 2012**

(87) PCT Pub. No.: **WO2011/158868**
PCT Pub. Date: **Dec. 22, 2011**

(65) **Prior Publication Data**

US 2013/0092434 A1 Apr. 18, 2013

(30) **Foreign Application Priority Data**

Jun. 18, 2010 (JP) 2010-138911

(51) **Int. Cl.**
H02G 3/04 (2006.01)
B60R 16/02 (2006.01)

(52) **U.S. Cl.**
CPC ***H02G 3/04*** (2013.01); ***B60R 16/0215*** (2013.01); ***H02G 3/0406*** (2013.01); ***H02G 3/0487*** (2013.01)

(58) **Field of Classification Search**
CPC .. H02G 3/0487; H02G 3/0462; H02G 3/0406; H02G 3/04
See application file for complete search history.

(56) **References Cited**

U.S. PATENT DOCUMENTS

4,972,041 A * 11/1990 Crawley H01B 7/0861 174/115
5,097,099 A * 3/1992 Miller H01B 7/0861 174/115

(Continued)

FOREIGN PATENT DOCUMENTS

CN 1667898 A 9/2005
CN 101553885 A 10/2009

(Continued)

OTHER PUBLICATIONS

Extended European Search Report, dated Oct. 24, 2013, issued by the European Patent Office in counterpart European Application No. 11795772.0.

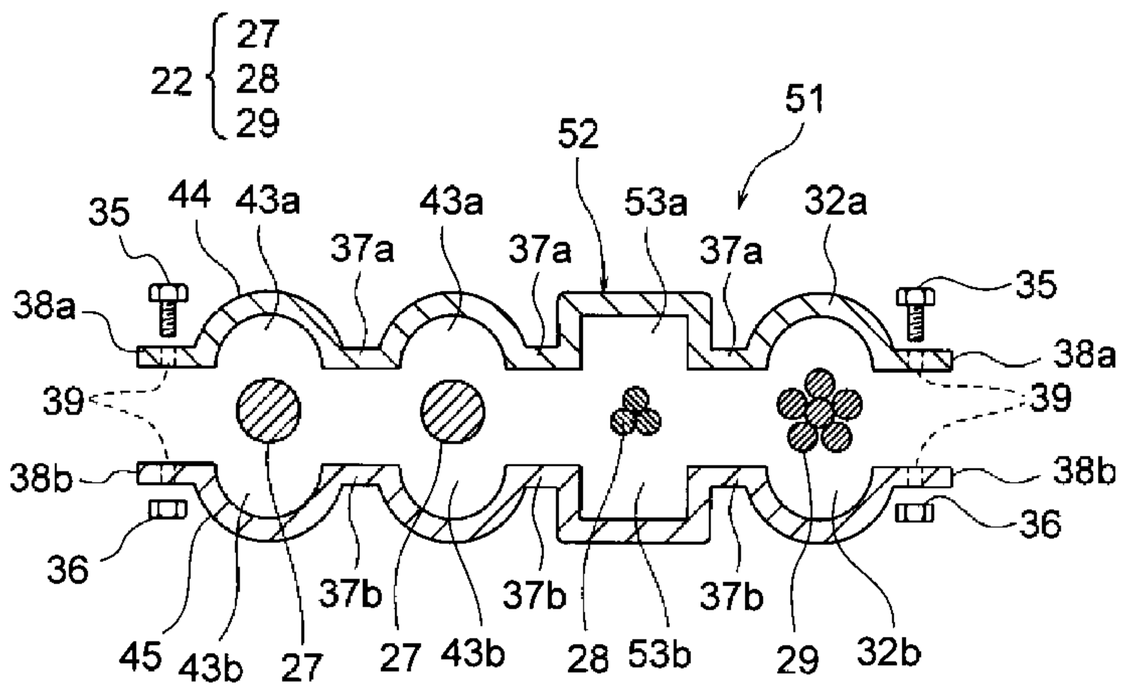
(Continued)

Primary Examiner — Zachary M Pape
Assistant Examiner — Douglas Burtner
(74) *Attorney, Agent, or Firm* — Sughrue Mion, PLLC

(57) **ABSTRACT**

An integrated shielding protector and a wire harness are provided so that the man-hours concerning the wiring operation can be reduced, and the number of components also can be reduced. A conductive integrated shielding protector, including a first high voltage accommodating part, a second high voltage accommodating part and a low voltage accommodating part, is used when first high voltage wires the voltage of which is high, second high voltage wires the voltage of which is high but lower than that of the first high voltage wires, and low voltage wires the voltage of which is low are wired in parallel in the same course. A wire harness, including the integrated shielding protector, the first high voltage wires, the second high voltage wires and the low voltage wires, is wired inside a vehicle compartment.

13 Claims, 6 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,171,938	A *	12/1992	Katsumata	H01B 7/08 174/105 SC
5,250,127	A *	10/1993	Hara	H01B 7/385 156/247
5,760,341	A *	6/1998	Laske	H01B 7/0009 174/113 R
5,821,467	A *	10/1998	O'Brien	H01B 7/40 174/117 AS
6,304,626	B1 *	10/2001	Adachi	G01N 23/046 378/19
8,013,249	B2	9/2011	Watanabe et al.	
2001/0035297	A1 *	11/2001	Tamai	H01B 7/0009 174/133 R
2003/0137053	A1 *	7/2003	Okayama	H01L 21/76838 257/758
2005/0007718	A1 *	1/2005	Stevenson	A61N 1/3754 361/118
2005/0011687	A1	1/2005	Yamaguchi et al.	
2005/0057320	A1 *	3/2005	Brandt	H02J 13/002 333/24 R
2005/0121222	A1 *	6/2005	Lee	H01B 11/12 174/113 R
2005/0162015	A1 *	7/2005	Yamaguchi	B60R 16/0215 307/10.1
2006/0027392	A1 *	2/2006	Victor	H01B 11/12 174/113 R
2006/0096777	A1 *	5/2006	Glew	H01B 11/04 174/113 C
2007/0102188	A1 *	5/2007	Glew	H01B 7/295 174/113 C
2007/0175652	A1 *	8/2007	Narumi	H01B 7/0838 174/117 F
2008/0315262	A1 *	12/2008	Kuriyama	H01L 27/14623 257/231
2009/0294149	A1 *	12/2009	Watanabe	H01B 7/16 174/102 R
2010/0012831	A1	1/2010	Vertes et al.	
2010/0045106	A1 *	2/2010	Oga	B60R 16/0215 307/10.1
2010/0051314	A1	3/2010	Watanabe et al.	
2011/0009039	A1 *	1/2011	Balagani	B23D 61/185 451/533
2011/0088944	A1 *	4/2011	Ogue	B60R 16/0215 174/72 A
2011/0127084	A1	6/2011	Ichikawa et al.	
2011/0132638	A1 *	6/2011	Oga	H02G 3/0462 174/135
2011/0133548	A1 *	6/2011	Toyama	B60R 16/0215 307/9.1

FOREIGN PATENT DOCUMENTS

JP	1298605	A	12/1989	
JP	2003143734	A	5/2003	
JP	2004224156	A	8/2004	
JP	2005237071	A	9/2005	
JP	2005291261	A *	10/2005	
JP	201047033	A	3/2010	
WO	2008069208	A1	6/2008	
WO	WO 2010148165	A2 *	12/2010	H01B 7/0861

OTHER PUBLICATIONS

Office Action, dated Aug. 9, 2013, issued by the Japanese Patent Office in counterpart Japanese Patent Application No. 2010-138911.
Communication issued on Dec. 31, 2014 by the State Intellectual Property Office of the People's Republic of China in related application No. 201180030129.1.
International Search Report dated Aug. 30, 2011 from the International Searching Authority in counterpart application No. PCT/JP2011/063710.
Written Opinion dated Aug. 30, 2011 from the International Searching Authority in counterpart application No. PCT/JP2011/063710.
Office Action dated Nov. 9, 2015 issued by the State Intellectual Property Office of P.R. China in counterpart Chinese Patent Application No. 201180030129.1.
Office Action dated Mar. 7, 2016, issued by the State Intellectual Property Office of P.R. China in counterpart Chinese Application No. 201180030129.1.
Communication dated Jun. 30, 2016 issued by Patent Office of the People's Republic of China in counterpart Chinese Application No. 201180030129.1.

* cited by examiner

FIG. 1A

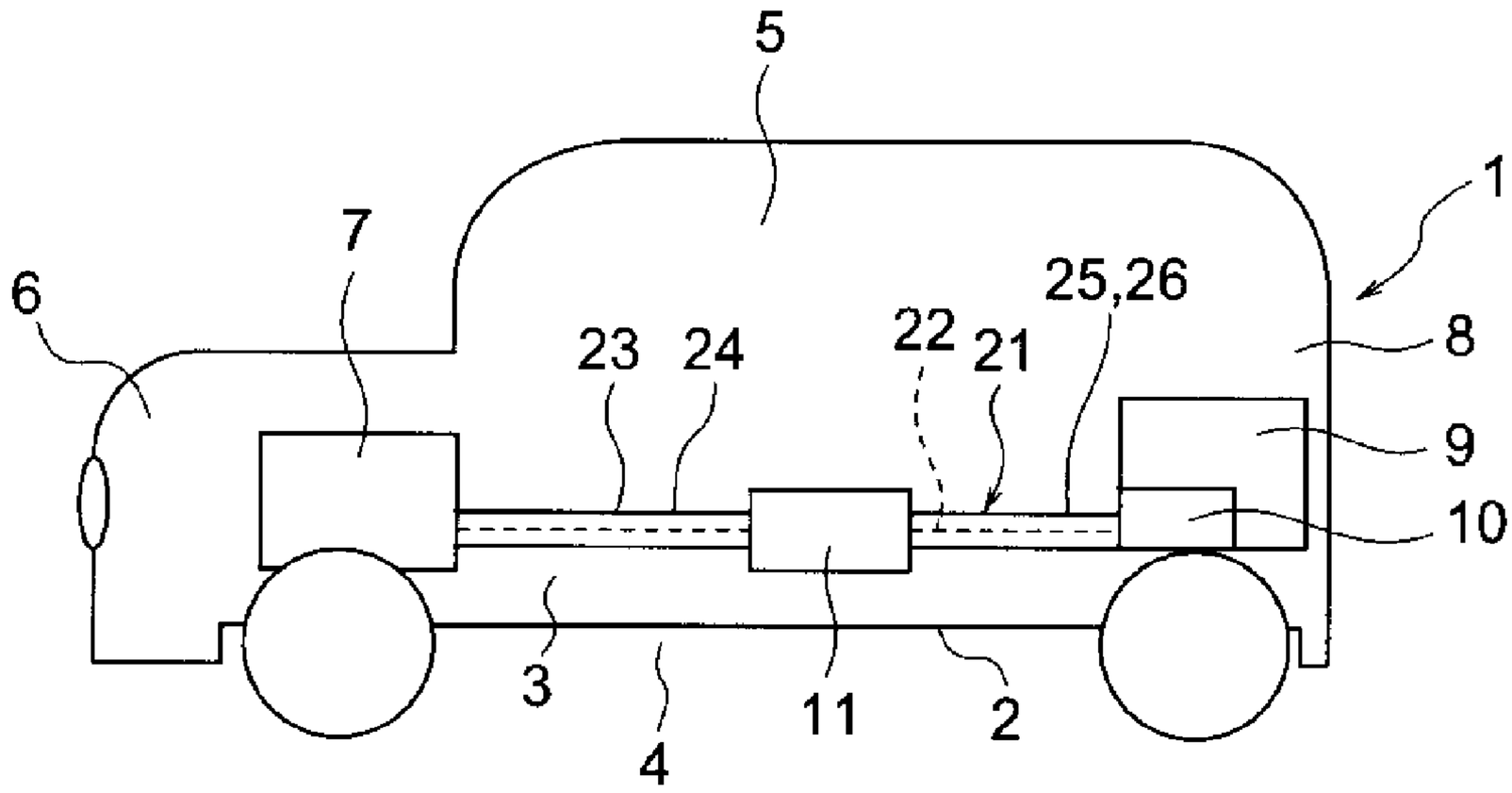


FIG. 1B

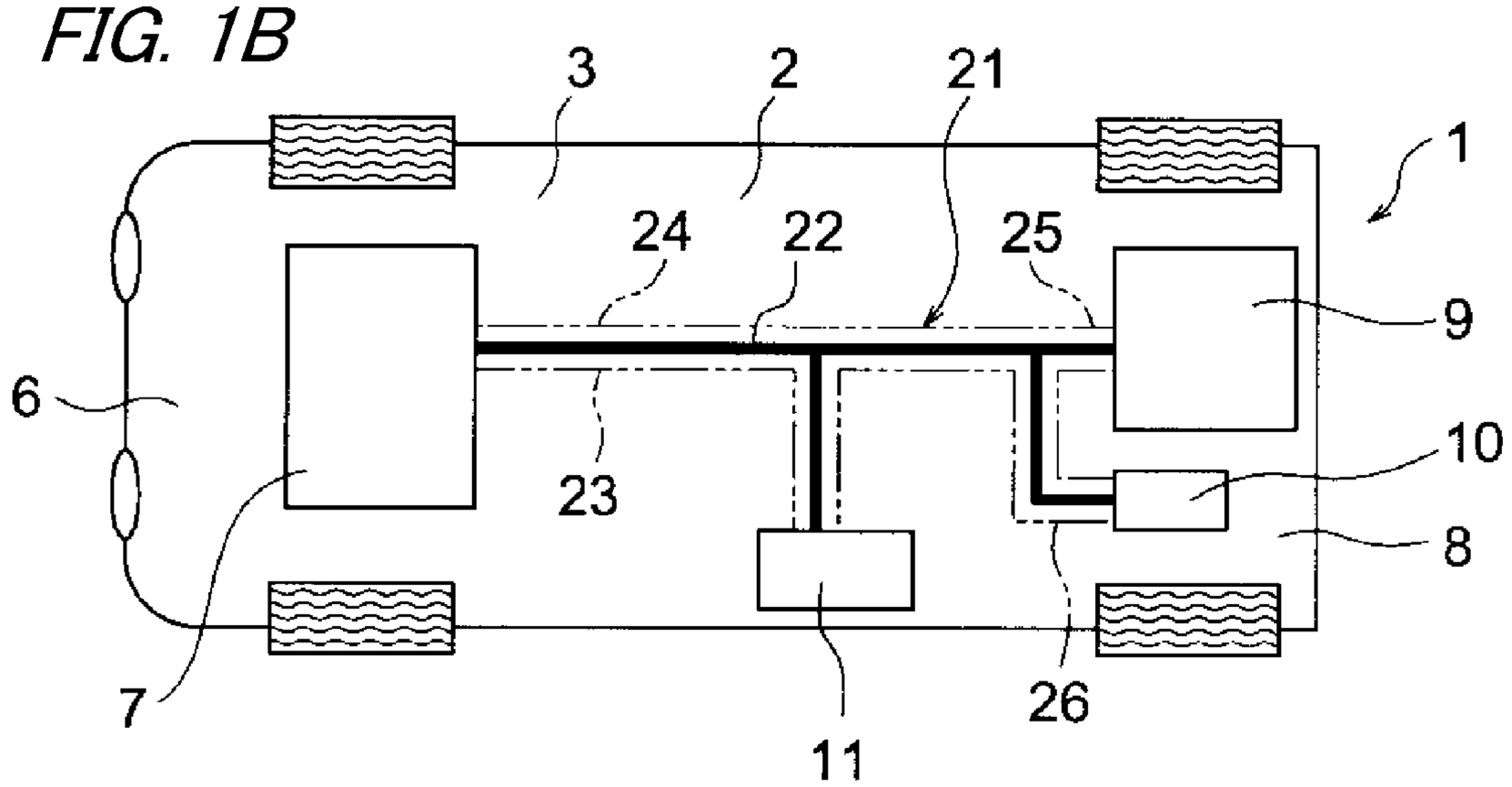


FIG. 2A

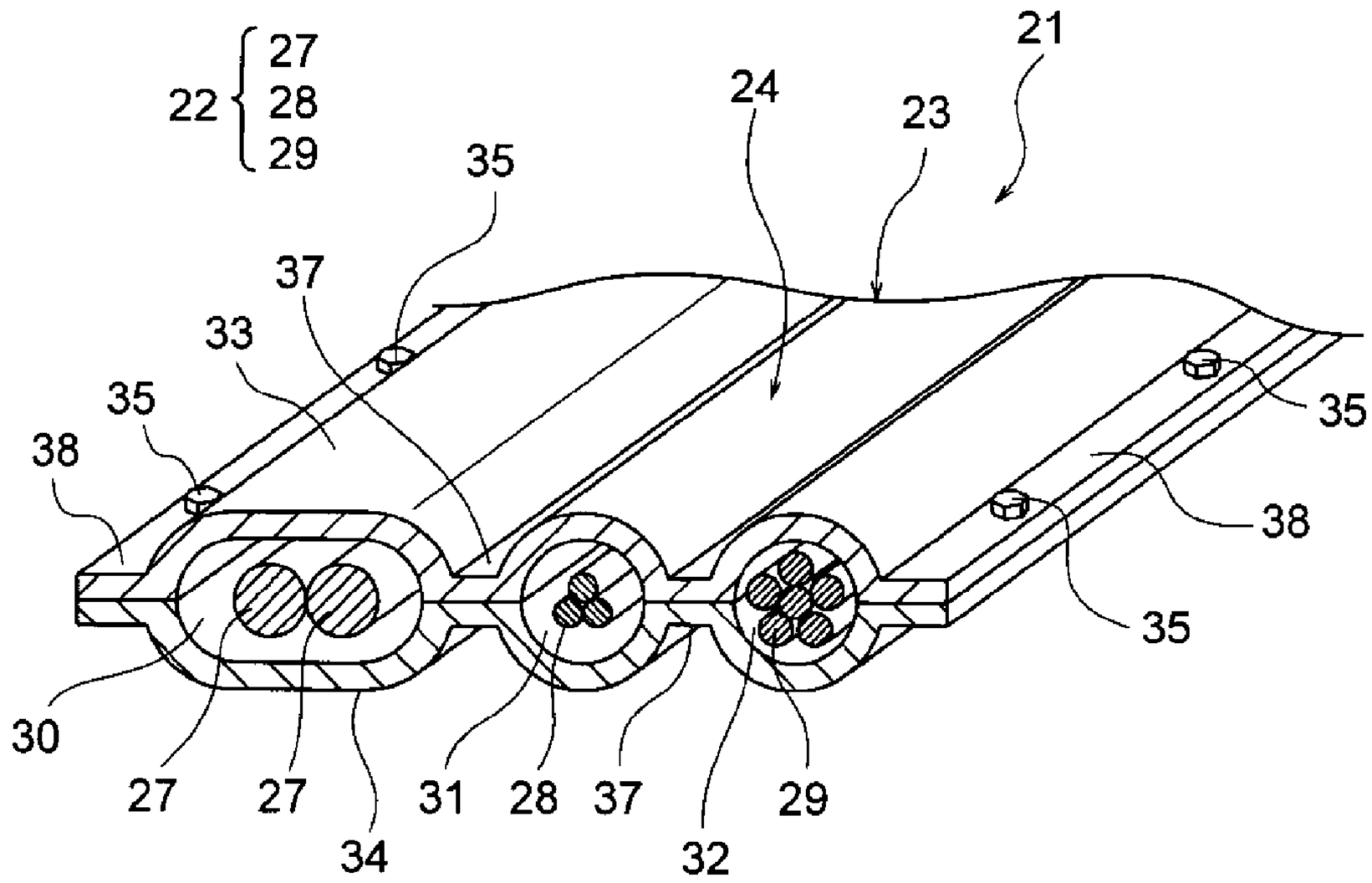

22
27
28
29
35
37
33
35
38
21
24
23
35
38
35
30
27
27
34
31
28
37
32
29

FIG. 2B

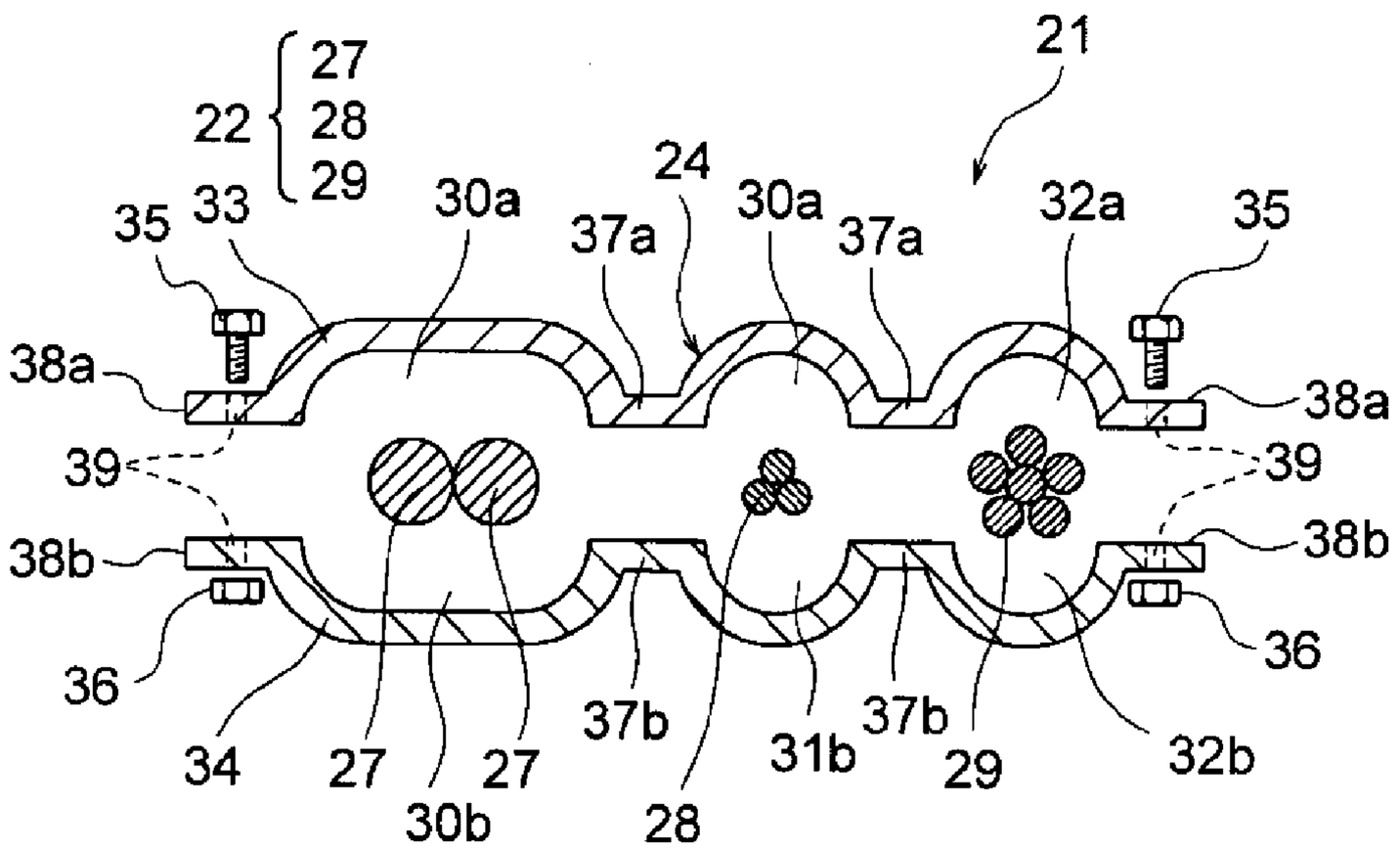

22
27
28
29
35
33
30a
24
37a
30a
37a
32a
35
21
38a
38a
39
39
38b
38b
36
36
34
27
27
30b
37b
28
31b
37b
29
32b

FIG. 3A

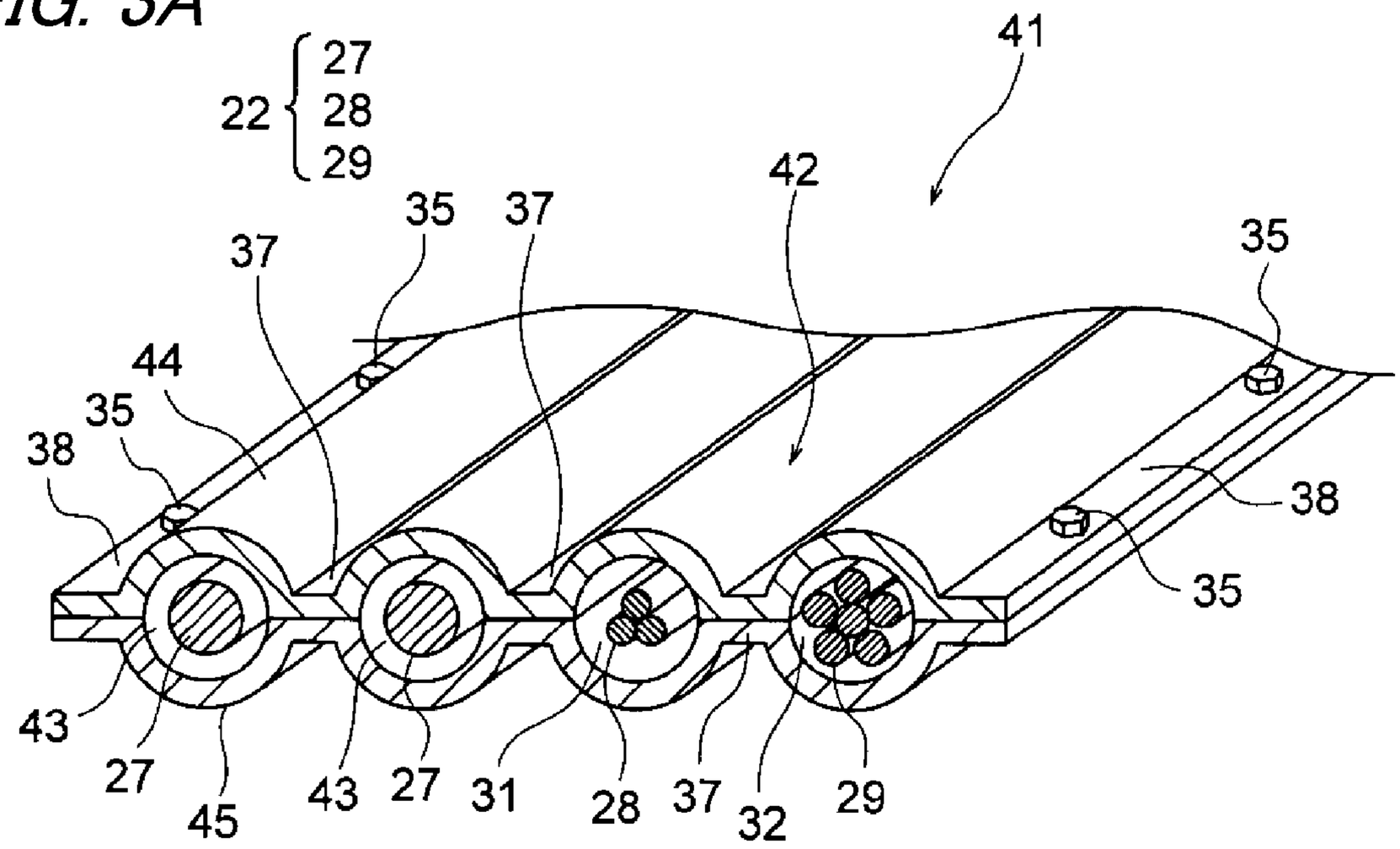

22
27
28
29
41
42
35
37
37
44
35
38
38
35
43
27
45
43
27
31
28
37
32
29

FIG. 3B

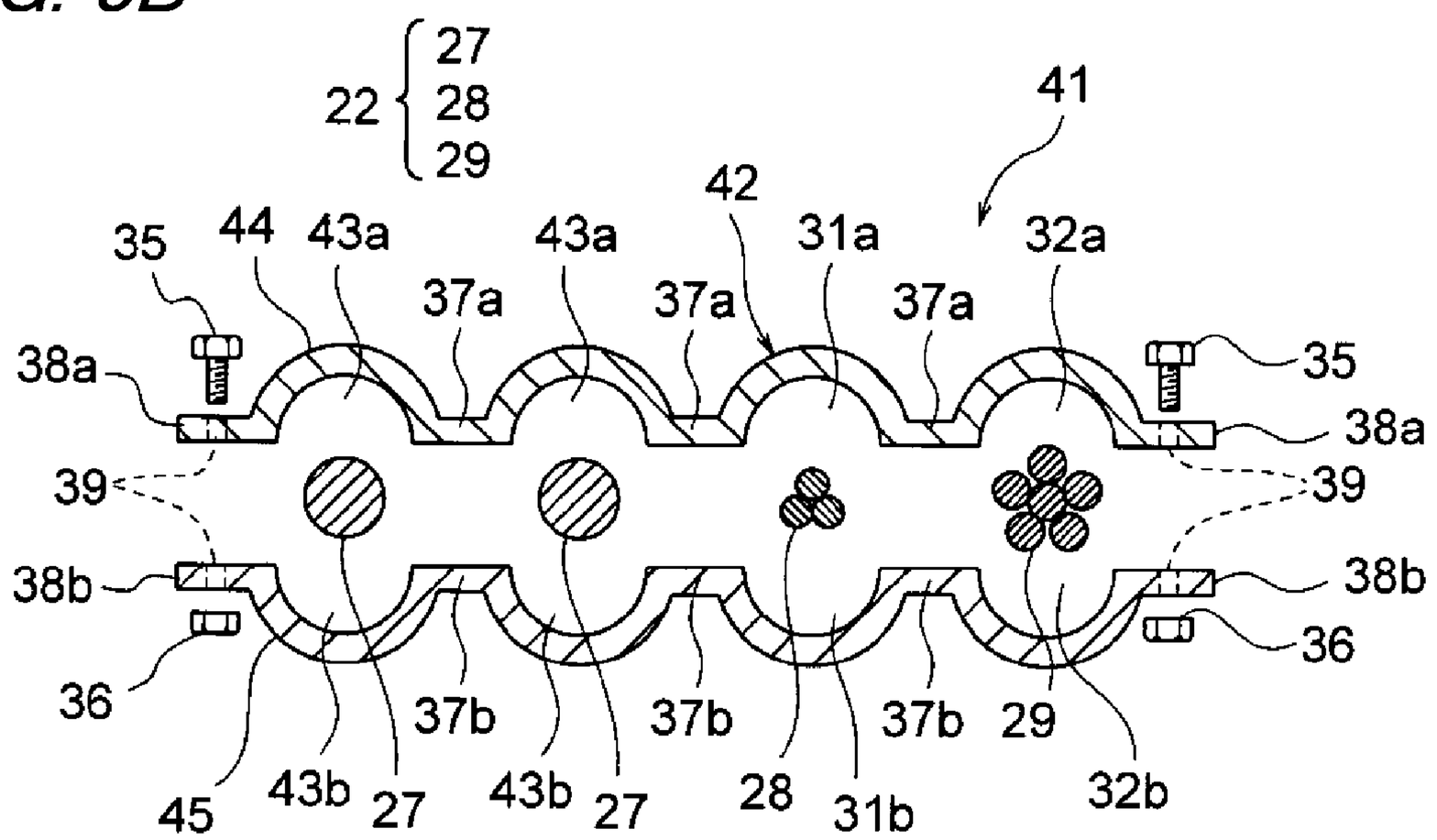

22
27
28
29
41
42
35
44
43a
43a
31a
32a
37a
37a
37a
35
38a
38a
39
39
38b
38b
36
36
37b
37b
37b
29
45
43b
27
43b
27
28
31b
32b

FIG. 4A

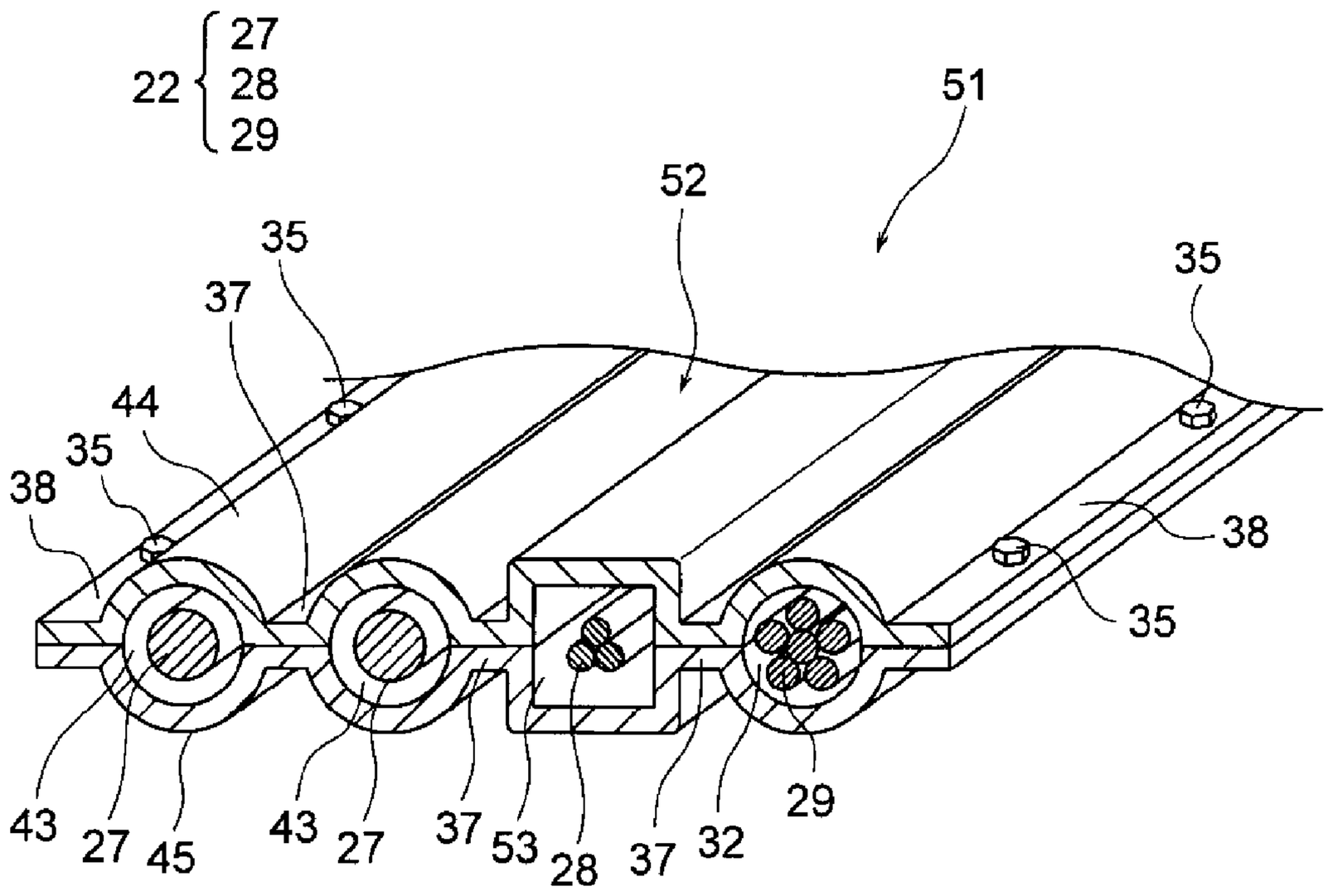

22
27
28
29
51
52
35
37
44
35
38
38
35
43
27
45
43
27
37
53
28
37
32
29

FIG. 4B

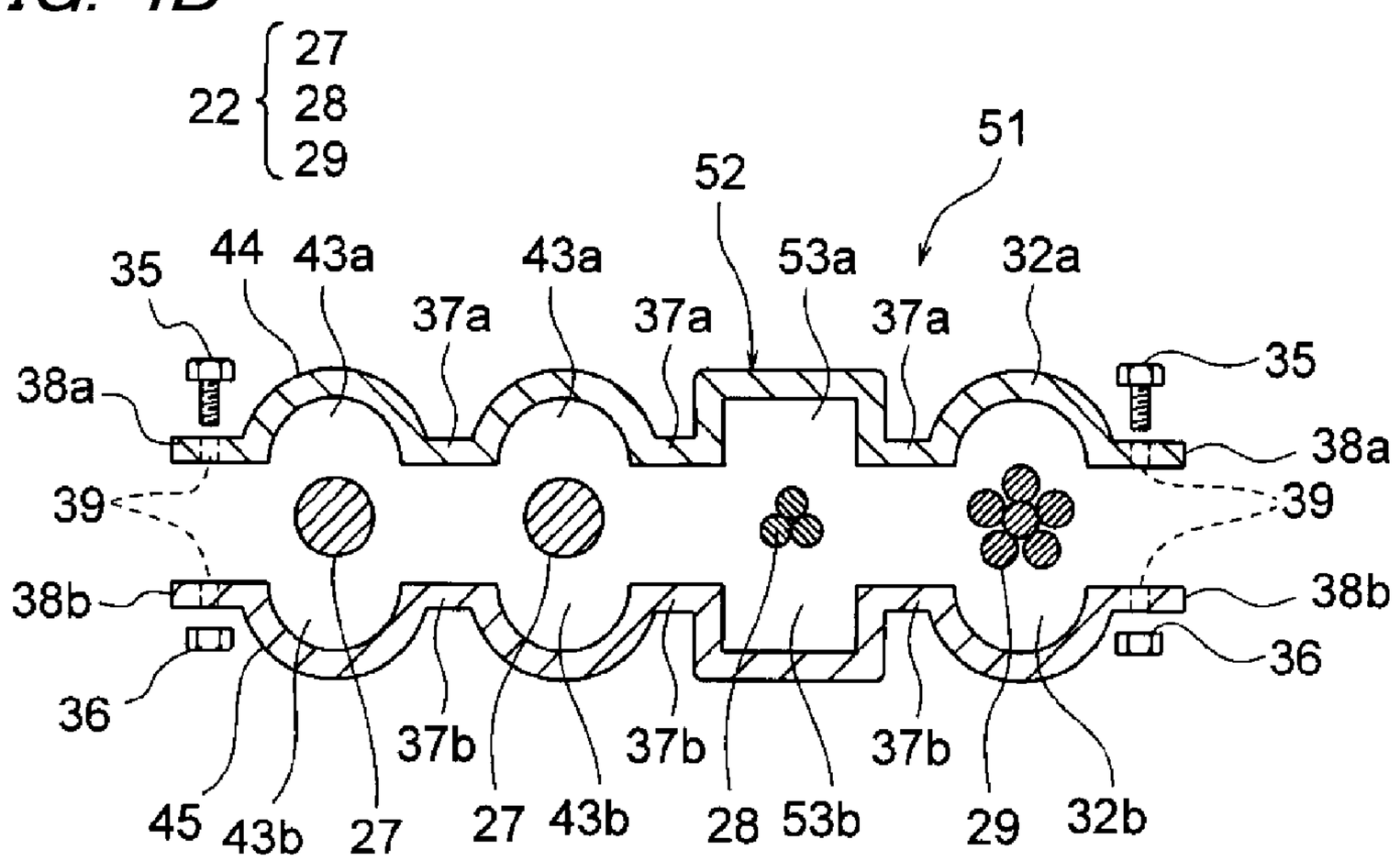

22
27
28
29
51
52
35
44
43a
43a
53a
32a
37a
37a
37a
35
38a
38a
39
39
38b
38b
36
36
37b
37b
37b
45
43b
27
27
43b
28
53b
29
32b

FIG. 5A

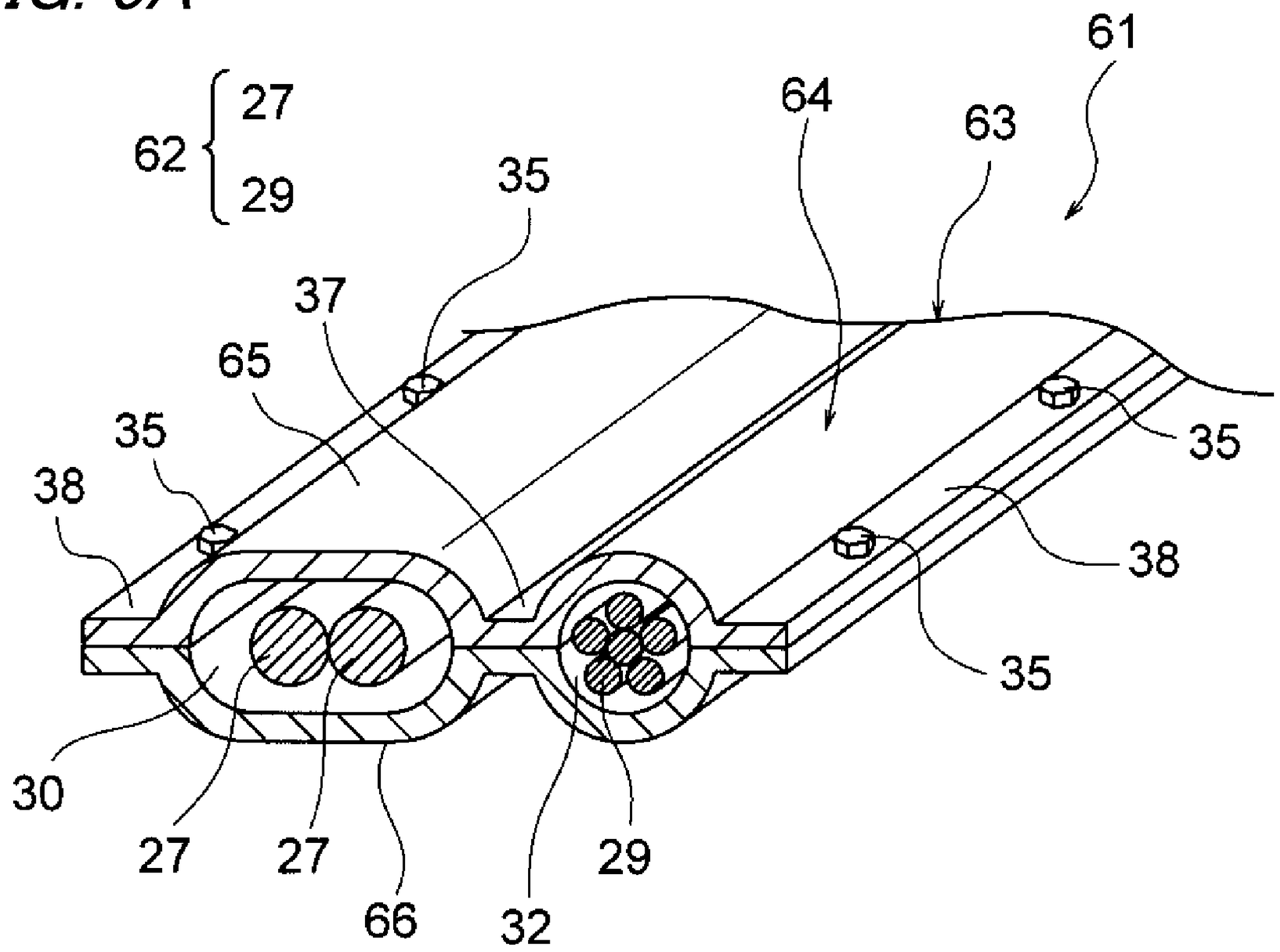

61
64
63
62
27
29
35
37
65
35
38
35
38
35
30
27
27
66
32
29

FIG. 5B

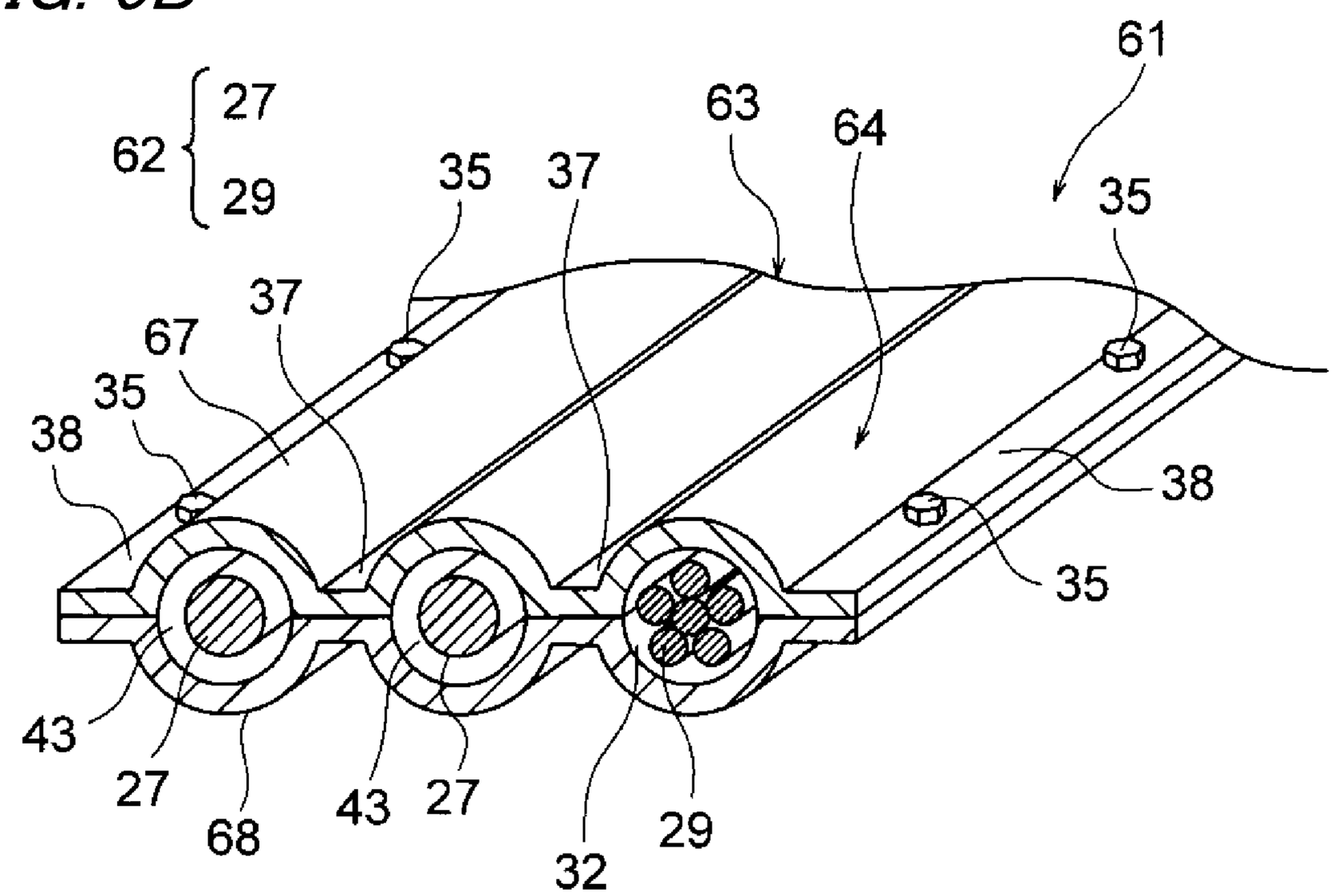

61
63
64
62
27
29
35
37
35
67
37
35
38
38
35
43
27
68
43
27
32
29

FIG. 6A

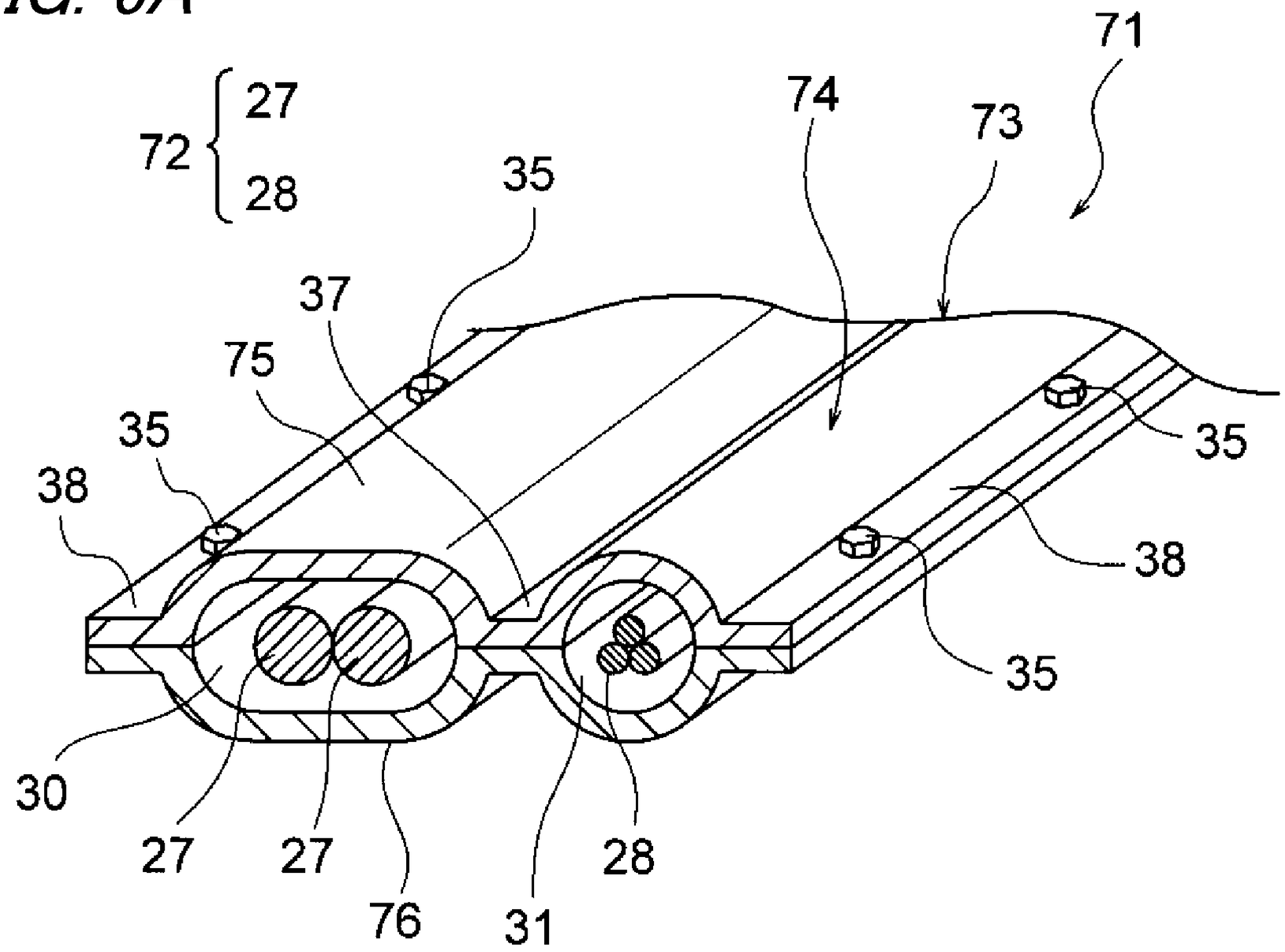
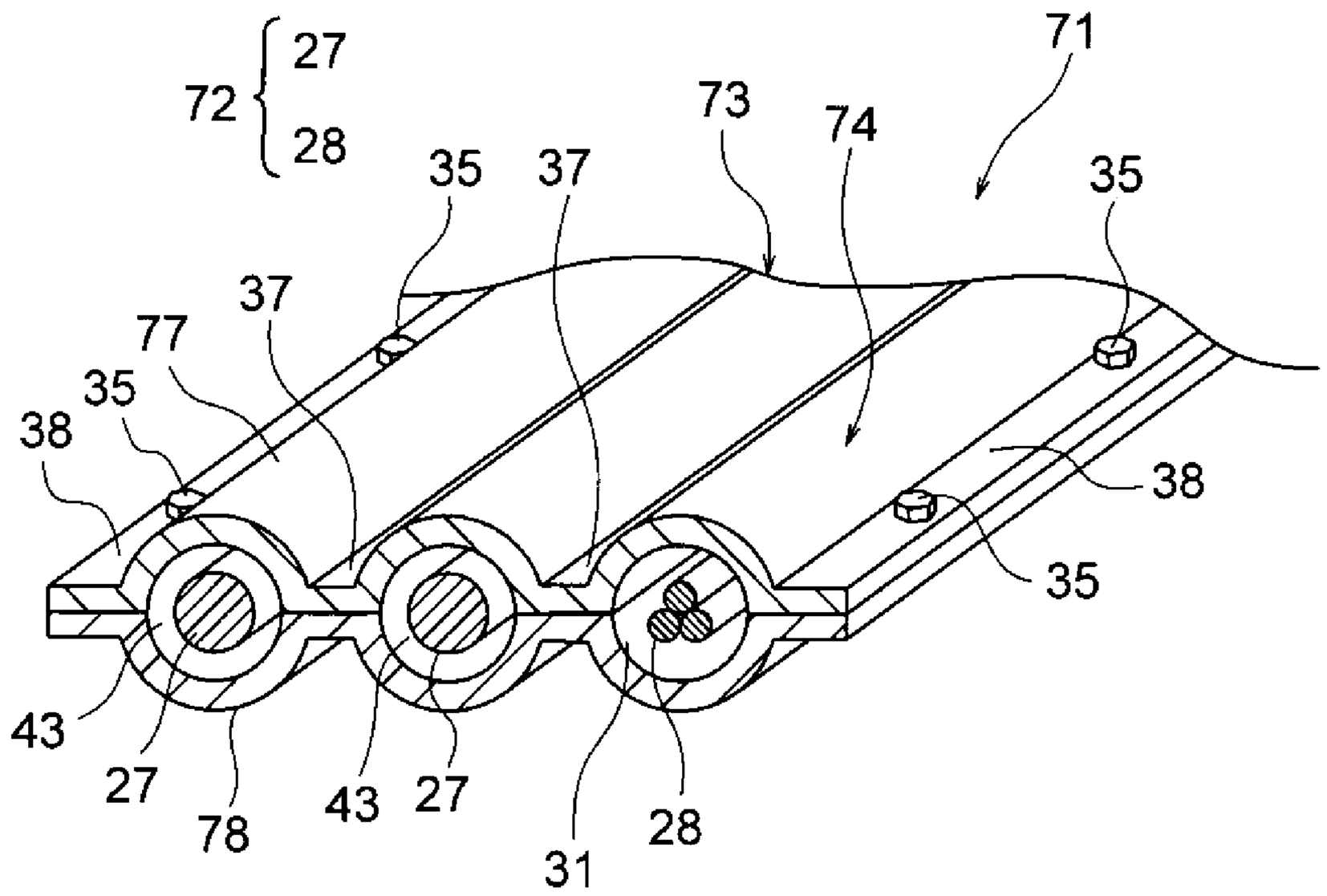

72
27
28
71
74
73
35
37
75
35
38
35
38
30
27
27
76
31
28

FIG. 6B


72
27
28
71
73
74
35
37
35
37
77
35
38
38
35
43
27
78
43
27
31
28

INTEGRATED SHIELDING PROTECTOR AND WIRE HARNESS

TECHNICAL FIELD

The present invention relates to an integrated shielding protector and a wire harness provided with the integrated shielding protector.

BACKGROUND ART

A plurality of high voltage electric wires are used to electrically connect with a battery and a motor-inverter in an electric vehicle or a hybrid vehicle. For example, in the following patent document 1, while the middle part of a plurality of high voltage electric wires is wired below a vehicle floor, the two ends of the plurality of high voltage electric wires are wired in an engine room of a vehicle front part or at a vehicle rear part by penetrating a vehicle frame. The plurality of high voltage electric wires are respectively inserted in metal protective pipes covering the overall length.

CITATION LIST

Patent Literature

[PTL 1] Japan Patent Publication No. 2004-224156

SUMMARY OF INVENTION

Technical Problem

In the above-mentioned related technique, since it is necessary to perform fixing operations relative to a part below the vehicle floor or penetrating operations to the vehicle frame in order to wire the plurality of high voltage electric wires, it is known that the operability concerning the wiring is not good. If it is considered to wire inside a vehicle compartment without the penetrating operations, the following new problems will arise.

That is, since the plurality of high voltage electric wires in the above-mentioned prior art are high voltage (288V) electric wires for an electric vehicle or a hybrid vehicle, when the electric wires are wired inside the vehicle compartment, a new problem will arise that the influence of electromagnetic noise will appear on an 12V low voltage electric wire or a 42V high voltage electric wire which are wired around inside the same vehicle compartment. If the electric wires are wired inside the vehicle compartment, a new problem will arise that the influence of electromagnetic noise will appear on an electronic device or the like which is carried inside the same vehicle compartment.

It is considered to provide shielding members, as a measure to solve the above new problems, for the plurality of high voltage electric wires wired inside the vehicle compartment and the 42V or 12V electric wires which are wired near the high voltage electric wires. However, the measure which provides a shielding member for each of the electric wires will lead to a problem that the number of components will increase, and a problem that the man-hours related to the wiring operation will increase.

The present invention is made in view of the above-mentioned situation, and the object of the invention is to provide an integrated shielding protector and a wire harness so that the man-hours concerning the wiring operation can be reduced and the number of components also can be reduced.

Solution to Problem

The above object of the invention is achieved with the following compositions.

(1) An integrated shielding protector, arranged at a position where a first high voltage electrical pathway the voltage of which is high and at least one of a second high voltage electrical pathway the voltage of which is high but lower than that of the first high voltage electrical pathway and a low voltage electrical pathway the voltage of which is low are wired in parallel in the same course,

formed of material having conductivity, and

divided for each voltage level and formed to integrally have at least one of a second high voltage accommodating part which accommodates the second high voltage electrical pathway and a low voltage accommodating part which accommodates the low voltage electrical pathway, and a first high voltage accommodating part which accommodates the first high voltage electrical pathway.

According to the integrated shielding protector of the above composition (1), when the integrated shielding protector has the first high voltage accommodating part, the second high voltage accommodating part and the low voltage accommodating part, these accommodating parts are divided for each voltage level, and the integrated shielding protector has conductivity. Therefore, if the first high voltage electrical pathway, the second high voltage electrical pathway and the low voltage electrical pathway are accommodated in the first high voltage accommodating part, the second high voltage accommodating part and the low voltage accommodating part, it will become possible to demonstrate a shielding function with one component. That is, it becomes possible to keep the second high voltage electrical pathway and the low voltage electrical pathway from being influenced by the electromagnetic noise generated from the first high voltage electrical pathway, for example. According to the integrated shielding protector of the above composition (1), since the first high voltage electrical pathway, the second high voltage electrical pathway and the low voltage electrical pathway are accommodated by one component, it becomes possible to reduce the number of components and the operating man-hours.

Alternatively, according to the integrated shielding protector of the above composition (1), when the integrated shielding protector has the first high voltage accommodating part and the second high voltage accommodating part or the low voltage accommodating part, these accommodating parts are divided for each voltage level, and the integrated shielding protector has conductivity. Therefore, if the first high voltage electrical pathway and the second high voltage electrical pathway or the low voltage electrical pathway are accommodated in the first high voltage accommodating part and the second high voltage accommodating part or the low voltage accommodating part, it will become possible to demonstrate a shielding function with one component. That is, it becomes possible to keep the second high voltage electrical pathway or the low voltage electrical pathway from being influenced by the electromagnetic noise generated from the first high voltage electrical pathway, for example. According to the integrated shielding protector of the above composition (1), since the first high voltage electrical pathway and the second high voltage electrical pathway or the low voltage electrical pathway are accom-

modated by one component, it becomes possible to reduce the number of components and the operating man-hours.

Thus, an effect is achieved that an integrated shielding protector can be provided so that the man-hours concerning the wiring operation can be reduced, and the number of components also can be reduced.

(2) The integrated shielding protector according to the above (1), wherein

as accommodating parts corresponding to a plurality of the first high voltage electrical pathways, a plurality of the first high voltage accommodating parts, the number of which corresponds to the number of the first high voltage electrical pathways, are formed in parallel.

According to the integrated shielding protector of the above composition (2), it will become possible to keep the plurality of first high voltage electrical pathways from being influenced by electromagnetic noise from each other.

Therefore, an effect is achieved that a shielding function can be demonstrated for each of the first high voltage electrical pathways. That is, an effect is achieved that the influence of electromagnetic noise between the first high voltage electrical pathways can be avoided.

(3) The integrated shielding protector according to the above (1) or (2), comprising

a pair of divided shielding protectors and fixing members adapted to fix the pair of divided shielding protectors to be fitted together.

Therefore, an effect is achieved that one type of the integrated shielding protector which is simple in composition and easy to be assembled can be provided.

According to the integrated shielding protector of the above composition (3), the pair of divided shielding protectors are fitted together so that the first high voltage electrical pathway, and the second high voltage electrical pathway and/or the low voltage electrical pathway are held between, and then the pair of divided shielding protectors are fixed by fixing members. By performing these operations, the assembly related to the integrated shielding protector is completed. That is, the assembly is simply completed.

(4) A wire harness comprising the integrated shielding protector according to the above (1) or (2), and a first high voltage electrical pathway the voltage of which is high and at least one of a second high voltage electrical pathway the voltage of which is high but lower than that of the first high voltage electrical pathway and a low voltage electrical pathway the voltage of which is low, which are wired in parallel in the same course by the integrated shielding protector.

According to the wire harness of the above composition (4), the first high voltage electrical pathway, and the second high voltage electrical pathway and/or the low voltage electrical pathway are separated for each voltage level and paralleled. According to the wire harness of the above composition (4), since the integrated shielding protector is included in composition, it becomes possible to accommodate electric wires in the integrated shielding protector and to demonstrate a shielding function.

Thus, an effect is achieved that a wire harness can be provided so that the man-hours concerning the wiring operation can be reduced, and the number of components also can be reduced.

(5) A wire harness according to the above (4), further comprising

conductive branch shielding protectors which are connected with the integrated shielding protector.

According to the wire harness of the above composition (5), it becomes possible to accommodate electric wires and to demonstrate a shielding function in a wide range besides the place where the first high voltage electrical pathway, and the second high voltage electrical pathway and/or the low voltage electrical pathway are wired in parallel in the same course.

Therefore, an effect is achieved that electric wires can be accommodated in a wide range. Further, an effect is achieved that a shielding function can be demonstrated in a wide range.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**A is a vertical cross sectional view which is a schematic block diagram that shows a wiring course of a wire harness which contains an integrated shielding protector of one embodiment of the present invention in composition, and FIG. **1**B is a horizontal sectional view of FIG. **1**A.

FIG. **2**A is a perspective view which contains a part of a cross section of the wire harness, and FIG. **2**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **2**A (an embodiment 1).

FIG. **3**A is a perspective view which contains a part of a cross section of another example of wire harness, and FIG. **3**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **3**A (an embodiment 2).

FIG. **4**A is a perspective view which contains a part of a cross section of another example of wire harness, and FIG. **4**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **4**A (an embodiment 3).

FIGS. **5**A and **5**B are perspective views which contain a part of a cross section of another example of wire harness (an embodiment 4).

FIGS. **6**A and **6**B are perspective views which contain a part of a cross section of another example of wire harness (an embodiment 5).

DESCRIPTION OF EMBODIMENTS

An integrated shielding protector and a wire harness related to one embodiment of the invention use a conductive integrated shielding protector which integrally has a first high voltage accommodating part, a second high voltage accommodating part and a low voltage accommodating part, when a first high voltage electrical pathway the voltage of which is high, a second high voltage electrical pathway the voltage of which is high but lower rather than that of the first high voltage electrical pathway, and a low voltage electrical pathway the voltage of which is low are wired in parallel in the same course. The wire harness which includes the integrated shielding protector, the first high voltage electrical pathway, the second high voltage electrical pathway and the low voltage electrical pathway in composition is wired inside a vehicle compartment.

Alternatively, when the first high voltage electrical pathway and one of the second high voltage electrical pathway and the low voltage electrical pathway are wired in parallel in the same course, the conductive integrated shielding protector which integrally has the first high voltage accommodating part and one of the second high voltage accommodating part and the low voltage accommodating part is used. The wire harness which includes the integrated shielding protector and the first high voltage electrical pathway etc. in composition is wired inside a vehicle compartment.

Embodiment 1

Next, an embodiment 1 is described with reference to the figures. FIGS. **1**A and **1**B are a vertical cross sectional view

and a horizontal cross sectional view which are schematic block diagrams that show a wiring course of a wire harness which contains an integrated shielding protector of the embodiment of the present invention in composition. FIG. **2**A is a perspective view which contains a part of a cross section of the wire harness, and FIG. **2**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **2**A.

In FIGS. **1**A and **1**B, a reference sign **1** shows a hybrid vehicle (or an electric vehicle). The hybrid vehicle **1** is a vehicle which is driven by mixing two powers of an engine and a motor, and the electric power from a battery will be supplied to the motor via an inverter. A reference sign **2** in the hybrid vehicle **1** shows a vehicle frame. In FIG. **1**A, a part **3** above a vehicle floor is shown above the vehicle frame **2**. A part **4** below the vehicle floor is shown below the vehicle frame **2**. A wire harness **21** of the present invention is wired in the part **3** above the vehicle floor. The wire harness **21** is wired in a length of the front and rear direction of the vehicle including a vehicle compartment **5**.

The wire harness **21** is connected to a plurality of devices **7** such as the inverter carried at the side of a vehicle front part **6**. The wire harness **21** is connected to a high voltage battery **9** or a low voltage battery **10** which are carried at the side of a vehicle rear part **8**. The wire harness **21** is connected to a DC to DC converter **11** which is carried at the side of the vehicle compartment **5**. The wiring course in FIGS. **1**A and **1**B is an example.

The wire harness **21** includes an electric wire group **22** and a shielding protector **23**. The shielding protector **23** is formed so that a shielding function (electromagnetic shielding function) can be demonstrated, while the electric wire group **22** can be accommodated separately for each voltage level. The shielding protector **23** of this embodiment includes an integrated shielding protector **24** which accounts for most of the shielding protector **23**, and branch shielding protectors **25** and **26** which are connected to the integrated shielding protector **24**.

The branch shielding protector **25** is included as a part corresponding to the electric wire group **22** connected to the high voltage battery **9**. The branch shielding protector **26** is included as a part corresponding to the electric wire group **22** connected to the low voltage battery **10**. The branch shielding protectors **25** and **26** are not particularly limited, but may be formed so that the integrated shielding protector **24** to be described below is extended.

The shielding protector **23** is grounded and fixed to the vehicle frame **2** via, for example, a bracket which has conductivity and which is not shown in the figure. (The shielding protector **23** is grounded and fixed to a part which may be grounded. While the shielding protector **23** is grounded by being directly contacted with the vehicle frame **2**, the shielding protector **23** may be grounded and fixed to the vehicle frame **2**, for example, with a clip. The fixing method shall not be particularly limited.)

Next, the composition, structure, and assembly of the wire harness **21** in the part of the integrated shielding protector **24** are described in detail with reference to FIGS. **2**A and **2**B.

In FIGS. **2**A and **2**B, the electric wire group **22** which forms the wire harness **21** has two first high voltage electric wires **27** as the first high voltage electrical pathways, a plurality of second high voltage electric wires **28** as the second high voltage electrical pathways whose voltage is lower than that of the first high voltage electric wires **27**, and a plurality of low voltage electric wires **29** as the low voltage electrical pathways.

The above-mentioned first high voltage electric wires **27** are publicly known high voltage electric wires (288V), and include conductors and insulators (coverings). The conductor in this embodiment is manufactured of copper, copper alloy or aluminum. The conductor may be either a conductor structure in which wires are twisted or a rod-like conductor structure whose cross section is a rectangular shape or a round shape (for example, conductor structure with a rectangular single core or a round single core).

The above-mentioned second high voltage electric wires **28** are publicly known high voltage electric wires (42V), and include conductors and insulators (coverings). The conductor in this embodiment is manufactured of copper or copper alloy. A conductor structure in which wires are twisted is used for the conductor.

The low voltage electric wires **29** are publicly known insulative wire cores (12V), and include conductors and insulators (coverings) similarly to the second high voltage electric wires **28**. The conductor is manufactured of copper or copper alloy. A conductor structure in which wires are twisted is used for the conductor.

A wiring course of the electric wire group **22** is formed when the two first high voltage electric wires **27**, the plurality of second high voltage electric wires **28** and the plurality of low voltage electric wires **29** are packed for each voltage level.

The shielding protector **23** which forms the wire harness **21** includes the integrated shielding protector **24** as mentioned above, and the branch shielding protectors **25** and **26** (refer to FIG. **1**B). The integrated shielding protector **24** is arranged in a position where the two first high voltage electric wires **27**, the plurality of second high voltage electric wires **28** and the plurality of low voltage electric wires **29**, which are packed for each voltage level, are wired in parallel in the same course. The integrated shielding protector **24** is formed as a component which has conductivity and which can demonstrate a shielding function.

The integrated shielding protector **24** has a first high voltage accommodating part **30**, a second high voltage accommodating part **31**, and a low voltage accommodating part **32** as accommodating parts for respectively accommodating the two first high voltage electric wires **27**, the plurality of second high voltage electric wires **28** and the plurality of low voltage electric wires **29** which are packed for each voltage level. The integrated shielding protector **24** dividably includes a pair of divided shielding protectors **33** and **34**, and a plurality of bolts **35** and nuts **36** (fixing member).

As shown in FIG. **2**B, the pair of divided shielding protectors **33** and **34** are formed so that the pair of divided shielding protectors **33** and **34** can be fitted together by sandwiching the two first high voltage electric wires **27**, the plurality of second high voltage electric wires **28** and the plurality of low voltage electric wires **29** which are packed for each voltage level, for example, in a vertical direction. The pair of divided shielding protectors **33** and **34** in a fitted state are formed by being fixed with the bolts **35** and the nuts **36**. As long as the pair of divided shielding protectors **33** and **34** can be fitted together and fixed, other fixing members besides the bolts **35** and the nuts **36** may be used.

The pair of divided shielding protectors **33** and **34** are formed by forging a metal plate (for example, steel plate) which has conductivity in this embodiment. (The forming of the pair of divided shielding protectors **33** and **34** is not limited to this. For example, it is also possible to mold by using synthetic resin material which has conductivity, or to

insertion mold with the above-mentioned metal plate and synthetic resin material which has conductivity.)

The first high voltage accommodating part **30**, the second high voltage accommodating part **31** and the low voltage accommodating part **32** are accommodating parts provided for each voltage level, and are formed to be separated by connecting parts **37** between these accommodating parts. The connecting parts **37** used as partitions are formed so that the leakage of electromagnetic noise may not arise and there is a predetermined interval between the accommodating parts. The parts of reference signs **38** formed at the sides of the integrated shielding protector **24** show fixing flange parts which has through holes **39** where bolts are inserted. The fixing flange parts **38** are formed like the connecting parts **37** except the through holes **39** where bolts are inserted.

In the divided shielding protector **33**, a reference sign **30***a* shows a part corresponding to the first high voltage accommodating part **30**, a reference sign **31***a* shows a part corresponding to the second high voltage accommodating part **31**, a reference sign **32***a* shows a part corresponding to the low voltage accommodating part **32**, a reference sign **37***a* shows a part corresponding to the connecting part **37**, and a reference sign **38***a* shows a part corresponding to the fixing flange part **38**, respectively. In the divided shielding protector **34**, a reference sign **30***b* shows a part corresponding to the first high voltage accommodating part **30**, a reference sign **31***b* shows a part corresponding to the second high voltage accommodating part **31**, a reference sign **32***b* shows a part corresponding to the low voltage accommodating part **32**, a reference sign **37***b* shows a part corresponding to the connecting part **37**, and a reference sign **38***b* shows a part corresponding to the fixing flange part **38**, respectively.

The first high voltage accommodating part **30** is formed as an accommodating part which accommodates the two first high voltage electric wires **27**. The second high voltage accommodating part **31** is formed as an accommodating part which accommodates the plurality of second high voltage electric wires **28**. The low voltage accommodating part **32** is formed as an accommodating part which accommodates the plurality of low voltage electric wires **29**. The first high voltage accommodating part **30** is formed to have a cross section of a generally ellipse shape. The second high voltage accommodating part **31** and the low voltage accommodating part **32** are formed to have a cross section of a circular shape.

The electric wire group **22** is adapted to be collectively accommodated by the above integrated shielding protector **24**. That is, the two first high voltage electric wires **27** are not individually accommodated by an exclusive shielding protector, the plurality of second high voltage electric wires **28** are not individually accommodated by an exclusive shielding protector, and the plurality of low voltage electric wires **29** are not individually accommodated by an exclusive shielding protector. Therefore, an effect is achieved that the number of components can be reduced by including the integrated shielding protector **24**, instead of the exclusive shielding protectors corresponding to each of the above electric wires. Further, an effect is achieved that the number of bolts and nuts for fixing can be reduced. Further, an effect is achieved that the connecting number of bolts and nuts can be reduced remarkably. In addition, an effect is achieved that the operability concerning the wiring of the wire harness **21** can be improved.

Embodiment 2

Next, an embodiment 2 is described with reference to the figures. FIG. **3**A is a perspective view which contains a part of a cross section of another example of wire harness, and FIG. **3**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **3**A. Furthermore, the components that are identical with those in the above-mentioned embodiment 1 are given identical numbers, and their detailed description is omitted.

In FIGS. **3**A and **3**B, the wire harness **41** of the embodiment 2 differs in that an integrated shielding protector **42** is included instead of the integrated shielding protector **24** of the embodiment 1. Next, the integrated shielding protector **42** is described.

In the integrated shielding protector **42**, two first high voltage accommodating parts **43** which have a circular cross section are formed by being paralleled so that two first high voltage electric wires **27** can be accommodated respectively. The two paralleled first high voltage accommodating parts **43** are separated by the connecting part **37**. The integrated shielding protector **42** dividably includes a pair of divided shielding protectors **44** and **45**, and a plurality of bolts **35** and nuts **36**. Reference signs **43***a* and **43***b* show parts corresponding to the first high voltage accommodating parts **43**. Other parts of the integrated shielding protector **42** than the above are formed similarly to the integrated shielding protector **24** of the embodiment 1.

The above integrated shielding protector **42** achieves an effect that a shielding function can be demonstrated for each one of the first high voltage electric wires **27**, in addition to the same effects as the integrated shielding protector **24** of the embodiment 1. That is, an effect is achieved that the influence of electromagnetic noise from any one of the plurality of first high voltage electric wires **27** can be avoided.

Embodiment 3

Next, an embodiment 3 is described with reference to the figures. FIG. **4**A is a perspective view which contains a part of a cross section of another example of wire harness, and FIG. **4**B is an exploded cross sectional view which shows the composition of the wire harness of FIG. **4**A. Furthermore, the components that are identical with those in the above-mentioned embodiment 2 are given identical numbers, and their detailed description is omitted.

In FIGS. **4**A and **4**B, a wire harness **51** of the embodiment 3 differs in that the cross section of the second high voltage accommodating part **31** in the integrated shielding protector **42** of the embodiment 2 is changed to a rectangular shape. That is, the wire harness **51** differs in that an integrated shielding protector **52** is included. Next, the integrated shielding protector **52** is described.

The integrated shielding protector **52** has a second high voltage accommodating part **53** whose cross section is a rectangular shape. A plurality of second high voltage electric wires **28** are accommodated in the second high voltage accommodating part **53** whose cross section is a rectangular shape. Reference signs **53***a* and **53***b* show parts corresponding to the second high voltage accommodating part **53**. Other parts of the integrated shielding protector **52** than the above are formed similarly to the integrated shielding protector **42** of the embodiment 2.

Although the second high voltage accommodating part **53** is formed to have a rectangular cross section in this embodiment, the embodiment is not limited to this but the first high voltage accommodating parts **43** may have a rectangular cross section. By making the shapes of the accommodating parts provided for each voltage level to be different, it becomes easy to identify.

The above integrated shielding protector **52** achieves an effect that the operability concerning the assembly can be improved, in addition to the same effects as the integrated shielding protector **42** of the embodiment 2.

Embodiment 4

Next, an embodiment 4 is described with reference to the figures. FIGS. **5**A and **5**B are perspective views which contain a part of a cross section of another example of wire harness. Furthermore, the components that are identical with those in the above-mentioned embodiments 1 and 2 are given identical numbers, and their detailed description is omitted.

In FIGS. **5**A and **5**B, a wire harness **61** of the embodiment 4 includes an electric wire group **62** and a shielding protector **63**. The shielding protector **63** is formed so that a shielding function (electromagnetic shielding function) can be demonstrated, while the electric wire group **62** can be accommodated separately for each voltage level. The shielding protector **63** of this embodiment includes an integrated shielding protector **64** which accounts for most of the shielding protector **63**, and branch shielding protectors which are not shown in the figure and which are connected to the integrated shielding protector **64**.

Next, the composition, structure, assembly of the wire harness **61** in the part of the integrated shielding protector **64** are described in detail.

The electric wire group **62** which forms the wire harness **61** has two first high voltage electric wires **27** and a plurality of low voltage electric wires **29**. A wiring course of the electric wire group **62** is formed when the two first high voltage electric wires **27** and the plurality of low voltage electric wires **29** are packed for each voltage level.

The integrated shielding protector **64** in the shielding protector **63** is arranged in a position where the two first high voltage electric wires **27** and the plurality of low voltage electric wires **29**, which are packed for each voltage level, are wired in parallel in the same course. The integrated shielding protector **64** is formed as a component which has conductivity and which can demonstrate a shielding function.

In the case of FIG. **5**A, the integrated shielding protector **64** has a first high voltage accommodating part **30** and a low voltage accommodating part **32** as accommodating parts for respectively accommodating the two first high voltage electric wires **27** and the plurality of low voltage electric wires **29** which are packed for each voltage level. In the case of FIG. **5**A, the integrated shielding protector **64** dividably includes a pair of divided shielding protectors **65** and **66**, and a plurality of bolts **35** and nuts **36** (fixing member).

On the other hand, in the case of FIG. **5**B, the integrated shielding protector **64** has two paralleled first high voltage accommodating parts **43** and a low voltage accommodating part **32**. In the case of FIG. **5**B, the integrated shielding protector **64** dividably includes a pair of divided shielding protectors **67** and **68**, and a plurality of bolts **35** and nuts **36** (fixing member).

The pair of divided shielding protectors **65** and **66** (**67** and **68**) are formed so that the pair of divided shielding protectors **65** and **66** (**67** and **68**) can be fitted together by sandwiching the two first high voltage electric wires **27** and the plurality of low voltage electric wires **29** which are packed for each voltage level, for example, in a vertical direction. The pair of divided shielding protectors **65** and **66** (**67** and **68**) in a fitted state are formed by being fixed with the bolts **35** and the nuts **36**.

The pair of divided shielding protectors **65** and **66** (**67** and **68**) are formed by forging a metal plate (for example, steel plate) which has conductivity in this embodiment. (The forming of the pair of divided shielding protectors **65** and **66** (**67** and **68**) is not limited to this. For example, it is also possible to mold by using synthetic resin material which has conductivity, or to insertion mold with the above-mentioned metal plate and synthetic resin material which has conductivity.)

The first high voltage accommodating part **30** and the low voltage accommodating part **32** (the first high voltage accommodating parts **43** and the low voltage accommodating part **32**) are accommodating parts provided for each voltage level, and are formed to be separated by connecting parts **37** between these accommodating parts. The connecting parts **37** used as partitions are formed so that the leakage of electromagnetic noise may not arise and there is a predetermined interval between the accommodating parts.

The electric wire group **62** is adapted to be collectively accommodated by the above integrated shielding protector **64**. That is, the two first high voltage electric wires **27** are not individually accommodated by an exclusive shielding protector, and the plurality of low voltage electric wires **29** are not individually accommodated by an exclusive shielding protector. Therefore, an effect is achieved that the number of components can be reduced by including the integrated shielding protector **64**, instead of the exclusive shielding protectors corresponding to each of the above electric wires. Further, an effect is achieved that the number of bolts and nuts for fixing can be reduced. Further, an effect is achieved that the connecting number of bolts and nuts can be reduced remarkably. In addition, an effect is achieved that the operability concerning the wiring of the wire harness **61** can be improved.

Embodiment 5

Next, an embodiment 5 is described with reference to the figures. FIGS. **6**A and **6**B are perspective views which contain a part of a cross section of another example of wire harness. Furthermore, the components that are identical with those in the above-mentioned embodiments 1 and 2 are given identical numbers, and their detailed description is omitted.

In FIGS. **6**A and **6**B, a wire harness **71** of the embodiment 5 includes an electric wire group **72** and a shielding protector **73**. The shielding protector **73** is formed so that a shielding function (electromagnetic shielding function) can be demonstrated, while the electric wire group **72** can be accommodated separately for each voltage level. The shielding protector **73** of this embodiment includes an integrated shielding protector **74** which accounts for most of the shielding protector **73**, and branch shielding protectors which are not shown in the figure and which are connected to the integrated shielding protector **74**.

Next, the composition, structure, assembly of the wire harness **71** in the part of the integrated shielding protector **74** are described in detail.

The electric wire group **72** which forms the wire harness **71** has two first high voltage electric wires **27** and a plurality of second high voltage electric wires **28**. A wiring course of the electric wire group **72** is formed when the two first high voltage electric wires **27** and the plurality of second high voltage electric wires **28** are packed for each voltage level.

The integrated shielding protector **74** in the shielding protector **73** is arranged in a position where the two first high voltage electric wires **27** and the plurality of second high

voltage electric wires **28**, which are packed for each voltage level, are wired in parallel in the same course. The integrated shielding protector **74** is formed as a component which has conductivity and which can demonstrate a shielding function.

In the case of FIG. **6**A, the integrated shielding protector **74** has a first high voltage accommodating part **30** and a second high voltage accommodating part **31** as accommodating parts for respectively accommodating the two first high voltage electric wires **27** and the plurality of second high voltage electric wires **28** which are packed for each voltage level. In the case of FIG. **6**A, the integrated shielding protector **74** dividably includes a pair of divided shielding protectors **75** and **76**, and a plurality of bolts **35** and nuts **36** (fixing member).

On the other hand, in the case of FIG. **6**B, the integrated shielding protector **74** has two paralleled first high voltage accommodating parts **43** and a second high voltage accommodating part **31**. In the case of FIG. **6**B, the integrated shielding protector **74** dividably includes a pair of divided shielding protectors **77** and **78**, and a plurality of bolts **35** and nuts **36** (fixing member).

The pair of divided shielding protectors **75** and **76** (**77** and **78**) are formed so that the pair of divided shielding protectors **75** and **76** (**77** and **78**) can be fitted together by sandwiching the two first high voltage electric wires **27** and the plurality of second high voltage electric wires **28** which are packed for each voltage level, for example, in a vertical direction. The pair of divided shielding protectors **75** and **76** (**77** and **78**) in a fitted state are formed by being fixed with the bolts **35** and the nuts **36**.

The pair of divided shielding protectors **75** and **76** (**77** and **78**) are formed by forging a metal plate (for example, steel plate) which has conductivity in this embodiment. (The forming of the pair of divided shielding protectors **75** and **76** (**77** and **78**) is not limited to this. For example, it is also possible to mold by using synthetic resin material which has conductivity, or to insertion mold with the above-mentioned metal plate and synthetic resin material which has conductivity.)

The first high voltage accommodating part **30** and the second high voltage accommodating part **31** (the first high voltage accommodating parts **43** and the second high voltage accommodating part **31**) are accommodating parts provided for each voltage level, and are formed to be separated by connecting parts **37** between these accommodating parts. The connecting parts **37** used as partitions are formed so that the leakage of electromagnetic noise may not arise and there is a predetermined interval between the accommodating parts.

The electric wire group **72** is adapted to be collectively accommodated by the above integrated shielding protector **74**. That is, the two first high voltage electric wires **27** are not individually accommodated by an exclusive shielding protector, and the plurality of second high voltage electric wires **28** are not individually accommodated by an exclusive shielding protector. Therefore, an effect is achieved that the number of components can be reduced by including the integrated shielding protector **74**, instead of the exclusive shielding protectors corresponding to each of the above electric wires. Further, an effect is achieved that the number of bolts and nuts for fixing can be reduced. Further, an effect is achieved that the connecting number of bolts and nuts can be reduced remarkably. In addition, an effect is achieved that the operability concerning the wiring of the wire harness **71** can be improved.

The integrated shielding protectors and the wire harnesses of the present invention are described in detail with reference to the specific embodiments, but the invention is not limited to the previously described embodiments, and besides, it is apparent that various modifications can be made without changing the purpose of the invention.

This application is based on the Japanese patent application (patent application 2010-138911) filed on Jun. 18, 2010, whose content is incorporated herein by reference.

INDUSTRIAL APPLICABILITY

According to the integrated shielding protectors and the wire harnesses of the invention, the number of components can be reduced while the man-hours concerning the wiring operation can be reduced.

REFERENCE SIGNS LIST

1—hybrid vehicle
2—vehicle frame
3—part above the vehicle floor
4—part below the vehicle floor
5—vehicle compartment
6—vehicle front part
7—device
8—vehicle rear part
9—high voltage battery
10—low voltage battery
11—DC to DC converter
21—wire harness
22—electric wire group
23—shielding protector
24—integrated shielding protector
25 and **26**—branch shielding protector
27—first high voltage electric wire (first high voltage electrical pathway)
28—second high voltage electric wire (the second high voltage electrical pathway)
29—low voltage electric wire (low voltage electrical pathway)
30—first high voltage accommodating part
31—second high voltage accommodating part
32—low voltage accommodating part
33 and **34**—divided shielding protector
35—bolt (fixing member)
36—nut (fixing member)
37—connecting part
38—fixing flange part
39—through hole where a bolt is inserted
41—wire harness
42—integrated shielding protector
43—first high voltage accommodating part
44 and **45**—divided shielding protector
51—wire harness
52—integrated shielding protector
53—second high voltage accommodating part
61—wire harness
62—electric wire group
63—shielding protector
64—integrated shielding protector
65 to **68**—divided shielding protector
71—wire harness
72—electric wire group
73—shielding protector
74—integrated shielding protector
75 to **78**—divided shielding protector

The invention claimed is:

1. An integrated shielding protector, arranged at a position where a first high voltage electrical pathway the voltage of which is high and at least one of a second high voltage electrical pathway the voltage of which is high but lower than that of the first high voltage electrical pathway and a low voltage electrical pathway the voltage of which is low are wired in parallel in the same course,

formed of material having conductivity, and

divided for each voltage level and formed to integrally have at least one of a second high voltage accommodating part which accommodates the second high voltage electrical pathway and a low voltage accommodating part which accommodates the low voltage electrical pathway, and a first high voltage accommodating part which accommodates the first high voltage electrical pathway,

wherein the first high voltage accommodating part and the second high voltage accommodating part are formed to have different cross-sectional shapes from each other,

wherein a cross-section of one of the first high voltage accommodating part and the second high voltage accommodating part is a circle and a cross-section of another of the first high voltage accommodating part and the second high voltage accommodating part a rectangle.

2. The integrated shielding protector according to claim **1**, wherein

as accommodating parts corresponding to a plurality of the first high voltage electrical pathways, a plurality of the first high voltage accommodating parts, the number of which corresponds to the number of the first high voltage electrical pathways, are formed in parallel.

3. The integrated shielding protector according to claim **1**, comprising

a pair of divided shielding protectors and fixing members adapted to fix the pair of divided shielding protectors to be fitted together.

4. A wire harness comprising an integrated shielding protector, the integrated shielding protector being arranged at a position where a first high voltage electrical pathway the voltage of which is high and at least one of a second high voltage electrical pathway the voltage of which is high but lower than that of the first high voltage electrical pathway and a low voltage electrical pathway the voltage of which is low are wired in parallel in the same course by the integrated shielding protector,

wherein the integrated shielding protector is formed of material having conductivity, and

wherein the integrated shielding protector is divided for each voltage level and formed to integrally have at least one of a second high voltage accommodating part which accommodates the second high voltage electrical pathway and a low voltage accommodating part which accommodates the low voltage electrical pathway, and a first high voltage accommodating part which accommodates the first high voltage electrical pathway, and

wherein the first high voltage accommodating part and the second high voltage accommodating part are formed to have different cross-sectional shapes from each other,

wherein a cross-section of one of the first high voltage accommodating art and the second high voltage accommodating part is a circle and a cross-section of another of the first high voltage accommodating part and the second high voltage accommodating part is a rectangle.

5. The wire harness comprising the integrated shielding protector according to claim **4**, wherein the integrated shielding protector further comprises a pair of divided shielding protectors and fixing members adapted to fix the pair of divided shielding protectors to be fitted together.

6. The wire harness according to claim **4**, further comprising

conductive branch shielding protectors which are connected with the integrated shielding protector.

7. The wire harness according to claim **5**, further comprising

conductive branch shielding protectors which are connected with the integrated shielding protector.

8. An integrated shielding protector for wiring a plurality of different voltage electrical pathways, the integrated shielding protector comprising:

a first shielding protector part and an opposing second shielding protector part, the first shielding protector part and the second shielding protector part having corresponding accommodating parts, which form a first accommodating portion and a second accommodating portion when the first shielding protector part and the second shielding protector part are affixed to one another;

wherein the first accommodating portion is configured to accept an electrical pathway of a first voltage and the second accommodating portion is configured to accept an electrical pathway of a second, different voltage,

wherein the integrated shielding protector comprises a conductive material, and wherein the first accommodating portion and the second accommodating portion are formed to have different cross-sectional shapes from each other,

wherein a cross-section of one of the first accommodating portion and the second accommodating portion is a circle and a cross-section of another of the first accommodating portion and the second accommodating portion is a rectangle.

9. The integrated shielding protector of claim **8**, wherein the first shielding protector part and the second shielding protector part are affixed to one another by fastening means including bolts and nuts.

10. The integrated shielding protector of claim **8**, wherein the integrated shielding protector comprises a conductive synthetic resin material.

11. The integrated shielding protector of claim **8**,

wherein the first shielding protector part and the second shielding protector part further comprise a third accommodating portion, the third accommodating portion is configured to accept an electrical pathway of a third voltage, different from the first and the second voltage,

wherein the integrated shielding protector is configured to prevent electromagnetic noise generated from a high voltage first electrical pathway from influencing the electrical pathways of the second and third voltages.

12. The integrated shielding protector according to claim **1**, wherein the low voltage accommodating part is adapted to accommodate a plurality of the low voltage electrical pathways.

13. The integrated shielding protector according to claim **1**, wherein the second high voltage accommodating portion is adapted to accommodate a plurality of second high voltage electrical pathways.

* * * * *